FIG. 1A

```
   1 CCCCGCGTCGGTCTTCCACCTCACCTTTCGAGCTGGCCGCCGCTTGCTGTGCGCAGTTTC   60
  61 GGGGGACTGGACCTTCCCTGGCTTTTAGCAGCGCCGAGCGCCATGGCGACCCTTTGCTGG  120
 121 GCAGGTGACCGATTCCGGGTGCCCGAAGGAGCTGGCGTGGGTCTGCCTTGCAGCCGCCCG  180
 181 CCTGGACAGGATGTTTGCTAGAGGGCTGAAGAGGAAATATGGTGACCAGGAAGAAGGAGT  240
   1           M  F  A  R  G  L  K  R  K  Y  G  D  Q  E  E  G  V    17
 241 AGAGGGTTTTGGCACTGTCCCTTCCTATAGCCTGCAGCGACAGTCACTCCTGGACATGTC  300
       E  G  F  G  T  V  P  S  Y  S  L  Q  R  Q  S  L  L  D  M  S    37
 301 CCTTGTCAAGCTCCAGCTCTGTCACATGCTAGTGGAGCCCAATCTCTGCCGCTCGGTCCT  360
       L  V  K  L  Q  L  C  H  M  L  V  E  P  N  L  C  R  S  V  L    57
 361 CATCGCCAACACAGTCCGGCAGATCCAGGAGGAAATGAGCCAGGATGGTGTGTGGCATGG  420
       I  A  N  T  V  R  Q  I  Q  E  E  M  S  Q  D  G  V  W  H  G    77
 421 GATGGCACCCCAGAATGTAGATCGGGCACCAGTTGAACGCCTGGTGTCCACAGAGATCCT  480
       M  A  P  Q  N  V  D  R  A  P  V  E  R  L  V  S  T  E  I  L    97
 481 GTGTCGTACAGTGAGGGGAGCTGAGGAAGAGCACCCTGCTCCTGAACTGGAAGATGCTCC  540
       C  R  T  V  R  G  A  E  E  E  H  P  A  P  E  L  E  D  A  P   117
 541 CTTGCAAAACTCGGTTTCCGAGCTCCCCATCGTTGGCTCAGCACCAGGGCAAAGGAACCC  600
       L  Q  N  S  V  S  E  L  P  I  V  G  S  A  P  G  Q  R  N  P   137
 601 TCAGAGCAGCCTCTGGGAGATGGACAGCCCACAAGAAAACAGGGGAAGCTTTCAGAAGTC  660
       Q  S  S  L  W  E  M  D  S  P  Q  E  N  R  G  S  F  Q  K  S   157
 661 ACTGGACCAGATATTTGAGACCCTGGAGAACAAAAACTCCAGTTCAGTGGAGGAACTCTT  720
       L  D  Q  I  F  E  T  L  E  N  K  N  S  S  S  V  E  E  L  F   177
 721 CTCAGATGTGGACAGCTCCTACTATGACCTGGACACAGTGCTAACAGGAATGATGAGTGG  780
       S  D  V  D  S  S  Y  Y  D  L  D  T  V  L  T  G  M  M  S  G   197
 781 GACCAAGTCCAGTCTCTGCAATGGCCTTGAGGGCTTTGCTGCAGCCACCCCTCCTCCCAG  840
       T  K  S  S  L  C  N  G  L  E  G  F  A  A  A  T  P  P  P  S   217
 841 TTCCACTTGCAAGTCTGACCTGGCTGAGCTGGACCATGTGGTAGAGATTCTGGTGGAGAC  900
       S  T  C  K  S  D  L  A  E  L  D  H  V  V  E  I  L  V  E  T   237
 901 CTGAGAGGCCACCCCAGTGGGCTAAGGGTGAGGCCACCAGTCCCCATGGAGCTCACGTGT  960
       *
 961 GTTGTGACCCAGAGACAGATAAGCACTTGTCCTAAGAGGGGCTCTGGCTCTTGAGCTCAT 1020
1021 TATCCTTTTGTGTGACATTGGACTCACTGTGGAGGATGGTGTGTCACAGCTATGTCTAGT 1080
1081 CTATTTTCAATTAGATAGGTGAACTTTCTAAAATTAAGTTTTATATGTTTTTGGGCAATA 1140
1141 TTTTGTCTTAAGATATATTTTTTAAACTTTTTATACTTTAGATTTTTTTCAGCTATTTTC 1200
1201 TTAAAAGTATATTTTTTCTACAAACATCCTCTGCTGCTACATTAGAAACATTTATAACCT 1260
1261 AAATACGATTGGTGTGTCATTTTAAAGGTTTAAATAGAAAACTTCTTTTGTTACTGAGTC 1320
1321 TCTACACTCCCAAGGCAACTGTAAATGTAGCCGGCCGGGTGTTTACATGAGAGGCTCCAG 1380
1381 TATGGTCTACATTCTAGTAGAGCTTGAAAAGAACCATGCACAGCTCCACTGCCCCCTCAC 1440
1441 TGGGTCTGCTCTGGCGGATCGGAGCTCTCTTCCTAGCCCCGTGTGCAGGATGGCTTTATT 1500
1501 TATGCCTATTTATATGTAAATGCCACTGAAAGCTAAGGTCTTACTCCTGGAAATCCCAAC 1560
1561 ACCAGTTCTTCAGGGACTGCTGTGAGGCAGTGCCTTATGCAGGTCTTGTCCTTGGCCATC 1620
1621 ACTGTCTGGTTCCCAGCCCAGCACATGTGACATGAGGACATGACATGCCCGAACCACCCA 1680
1681 GCACCACATGCTCCATGTCAAGTGTGTACGTGGAGACCACTGGCTCCCAGGCCTGTGCTC 1740
1741 AGAGAGGGTGTGCAGTCCTACGTGTGCTGGGGGGGACGACGGTGACCTGTGCTTGCTTGC 1800
1801 TTTTAAAATGGTGCTTGGACGTTTTAAGGTTAAAAACAATCCGACTCCATATGATTTAGG 1860
1861 GCTCCTCCACCCTGGGGTGGCCCCTATGCTGTCTGCTTGGATCTCAAAGTCTTGGTACTC 1920
1921 GGCACTGTCAGACTCCACCCCATGTATCCTTTTTGTTTCTCTTGTGCTTTTTTTGGACTT 1980
1981 CCCAACCTGAGCCTAAGGTTTTATTTTATATGTGCTTCAATATCAACAATGTAAACCTCA 2040
2041 CTTTATTAAAAGTATCCAGCAAATGGAAAAAAAAAAAAAAAA
```

FIG. 1B

```
   1 GGGAAGCTGGCGGCACAGCCGTGGCGCCTGGCTGAGCAGAGGACCCGGCGGGCGGCCTCG   60
  61 CGGGTCAGGACACAATGTTTGCACGAGGACTGAAGAGGAAATGTGTTGGCCACGAGGAAG  120
   1                 M  F  A  R  G  L  K  R  K  C  V  G  H  E  E  D   16
 121 ACGTGGAGGGAGCCCTGGCCGGCTTGAAGACAGTGTCCTCATACAGCCTGCAGCGGCAGT  180
       V  E  G  A  L  A  G  L  K  T  V  S  S  Y  S  L  Q  R  Q  S   36
 181 CGCTCCTGGACATGTCTCTGGTGAAGTTGCAGCTTTGCCACATGCTTGTGGAGCCCAACC  240
       L  L  D  M  S  L  V  K  L  Q  L  C  H  M  L  V  E  P  N  L   56
 241 TGTGCCGCTCAGTCCTCATTGCCAACACGGTCCGGCAGATCCAAGAGGAGATGACGCAGG  300
       C  R  S  V  L  I  A  N  T  V  R  Q  I  Q  E  E  M  T  Q  D   76
 301 ATGGGACGTGGCGCACAGTGGCACCCCAGGCTGCAGAGCGGGCGCCGCTCGACCGCTTGG  360
       G  T  W  R  T  V  A  P  Q  A  A  E  R  A  P  L  D  R  L  V   96
 361 TCTCCACGGAGATCCTGTGCCGTGCAGCGTGGGGGCAAGAGGGGGCACATCCTGCTCCTG  420
       S  T  E  I  L  C  R  A  A  W  G  Q  E  G  A  H  P  A  P  G  116
 421 GCTTGGGGGACGGCCACACACAGGGTCCAGTTTCTGACCTTTGCCCAGTCACCTCAGCAC  480
       L  G  D  G  H  T  Q  G  P  V  S  D  L  C  P  V  T  S  A  Q  136
 481 AGGCACCAAGGCACCTGCAGAGCAGCGCCTGGGAGATGGATGGCCCTCGAGAAAACAGAG  540
       A  P  R  H  L  Q  S  S  A  W  E  M  D  G  P  R  E  N  R  G  156
 541 GAAGCTTTCACAAGTCACTTGATCAGATATTTGAAACGCTGGAGACTAAAAACCCCAGCT  600
       S  F  H  K  S  L  D  Q  I  F  E  T  L  E  T  K  N  P  S  C  176
 601 GCATGGAAGAGCTGTTCTCAGACGTGGACAGCCCCTACTACGACCTGGACACAGTACTGA  660
       M  E  E  L  F  S  D  V  D  S  P  Y  Y  D  L  D  T  V  L  T  196
 661 CAGGCATGATGGGGGGTGCCAGGCCGGGCCCCTGCGAAGGGCTCGAGGGCTTGGCTCCGG  720
       G  M  M  G  G  A  R  P  G  P  C  E  G  L  E  G  L  A  P  A  216
 721 CCACCCCAGGCCCTAGCTCCAGCTGCAAGTCCGACCTGGGCGAGCTGGACCACGTGGTGG  780
       T  P  G  P  S  S  S  C  K  S  D  L  G  E  L  D  H  V  V  E  236
 781 AGATCCTGGTGGAGACCTGAGCAGGAGCCCTGAGTGCTCACAGCCGCCTCTGACGCATTG  840
       I  L  V  E  T  *                                            241
 841 ACACGTGAGCACTGGCTCCCACGGAGGGTGCGCCTGCCGCCAGCGGCCCAGCCTTGCTGC  900
 901 CCTGTCTGCTGATTCTGAGAAATCCCAGAACAGCCCATTACCAGTGGGGCTGCAGCCCTA  960
 961 GGCCCGTCCCACTCACCTCCCCCCTGTGGAGCGCCAGGCAGAGGCTGTTCTGGAAGGCTT 1020
1021 CTTGTCTTCTGACGTCCCCACAGCCCTGGGCCCCTCGTGTCTCTTTGTGTCCCCCACTGT 1080
1081 AGAGGACGGTGAGCCGCAGCTGCATCAACCTCCTTTTACCTTTAGATAGGTGAATTTTTA 1140
1141 CAATTCAGTTTTACATGTTTTGGGCAGTATTTTGTCTTAAGATATATTTTTTAAACTTTT 1200
1201 TATACCTTATCTCTTTAGATTTTTTCAGCTATTTTCTTAAAAGTATATTTTTTCTATAAA 1260
1261 CATCCTTTGCTGCTACATTAGAACTTTTATAGCCTAAACAATTGCAGTTGGTGTGTTTCA 1320
1321 TTTTTTTAAGGTTTAAATAAGGGTTTTTTGTTTTGTTTTGTTTTTTGCAGTGAGCATCAC 1380
1381 TACAGTCTCAGTCAACAGTGTGAATGTATCATGTTTTACTTTAAATGTGTGTGTGATACT 1440
1441 TCTTCATTATGTCCTGCGCTGCAGTGAGACCTGGGTGAAAATCAGGAGCCGCACACAGCC 1500
1501 ACATCTTCCTAGACCTAAGAGTAAATTATGGAGGATTTTATTTATGTCTATTTATATGTA 1560
1561 AATGTCATTGAAGACAAAGGTCAAATATTTGTCTGTTTGTAGATCACAGGCACCAGTTGG 1620
1621 TCTTCAGGGACCTCATAGCCCCTCGGTGGTGCCTTCTCAAGGCAGTGTTCCTGGAGGCTC 1680
1681 CCATCAGGGTCAGCCCATGCACCTGCCCTGGGTGAGGAAGTAGCATTGCTGCTGGATGAG 1740
1741 AAACGCCTGCGCTGCTCTGTTAGACTGGTGCTGAAACAAAAGGTTAAGGCTAGGTTGAAG 1800
1801 TCTAGAATGAAAGAAATCTGAATCCATGTCATTCATAACCCCTTGATCTGTAGTGTCATG 1860
1861 GGTGCTGCCGCAGGCAGGGAGTGAGCTGGGGGTGCCTGCAGCCTTCCACTCCTGCCCCGC 1920
1921 CTCACCCCACATGCTCCCTGTTTCTCATGCTTTCTCTAACTTCCTCACCCCTTAACCAAA 1980
1981 AAGGTGTGTTTTCTTTTGTGCATATAGCCATTCTTAAATATCAGTGATGTAAACCTCACT 2040
2041 TTATTAAAAAATTATCCAGCAAAAAAAAAAAAAAAAAAAAA
```

FIG. 2

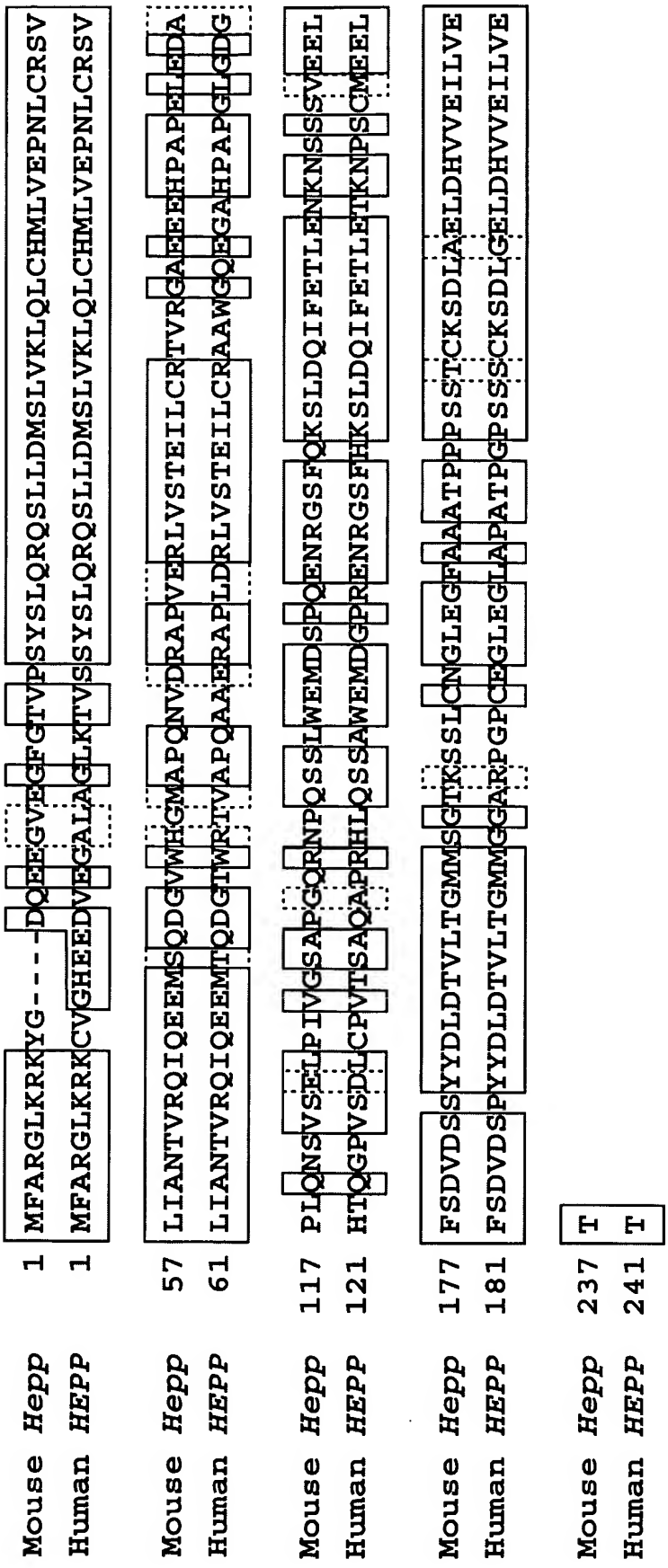

Mouse Hepp 1 MFARGLKRKYG---DQEEGVEGFGTVPSYSLQRQSLLDMSLVKLQLCHMLVEPNLCRSV
Human HEPP 1 MFARGLKRKCVGHEEDVEGALAGLKTVSSYSLQRQSLLDMSLVKLQLCHMLVEPNLCRSV
Mouse Hepp 57 LIANTVRQIQEEMSQDGVWTGMAPQNVDRAPVERLVSTEILCRTVRGAEEHPAPELEDA
Human HEPP 61 LIANTVRQIQEEMTQDGTWRTVAPQAAERAPLDRLVSTEILCRAAWGQEGAHPAPGLGDG
Mouse Hepp 117 PLQNSVSELPIVGSAPGQRNPQSSLWEMDSPQENRGSFQKSLDQIFETLENKNSSSVEEL
Human HEPP 121 HTQGPVSDLCPVTSAQAPRHLQSSAWEMDGPRENRGSFHKSLDQIFETLETKNPSCMEEL
Mouse Hepp 177 FSDVDSSYYDLDTVLTGMMSGTKSSLCNGLEGFAAATPPPSSTCKSDLAELDHVVEILVE
Human HEPP 181 FSDVDSPYYDLDTVLTGMMGGARPGPCEGLEGLLAPATPGPSSSCKSDLGELDHVVEILVE
Mouse Hepp 237 T
Human HEPP 241 T

FIG. 3

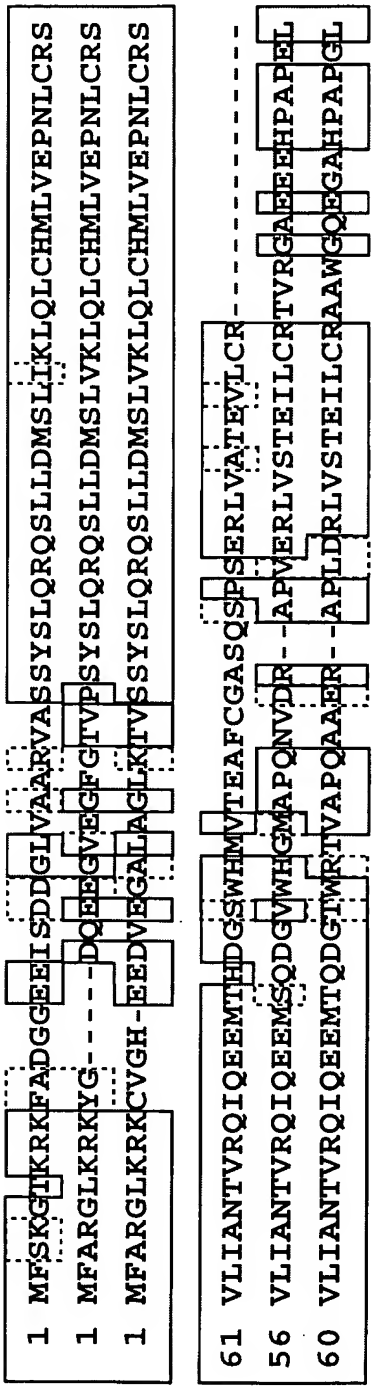

Zebrafish Hepp
Mouse Hepp
Human HEPP
1 MFSKGIKRKFADGGEEISDDGLVAARVASSYSLQRQSLLDMSLIKLQLCHMLVEPNLCRS
1 MFARGLKRKYG----DQEEGVEGFGTVPSYSLQRQSLLDMSLVKLQLCHMLVEPNLCRS
1 MFARGLKRKCVGH-EEDVEGALAGLKITVSSYSLQRQSLLDMSLVKLQLCHMLVEPNLCRS
Zebrafish Hepp
Mouse Hepp
Human HEPP
61 VLIANTVRQIQEEMTHDGSWHMVTEAFCGASQSPSERLVATEVLCR----------
56 VLIANTVRQIQEEMSQDGVWHGMAPQNVDR--APVERLVSTEILCRTVRGAEEHPAPEL
60 VLIANTVRQIQEEMTQDGTWRTVAPQAAER--APLDRLVSTEILCRAAWGQEGAHPAPGL

FIG. 4B

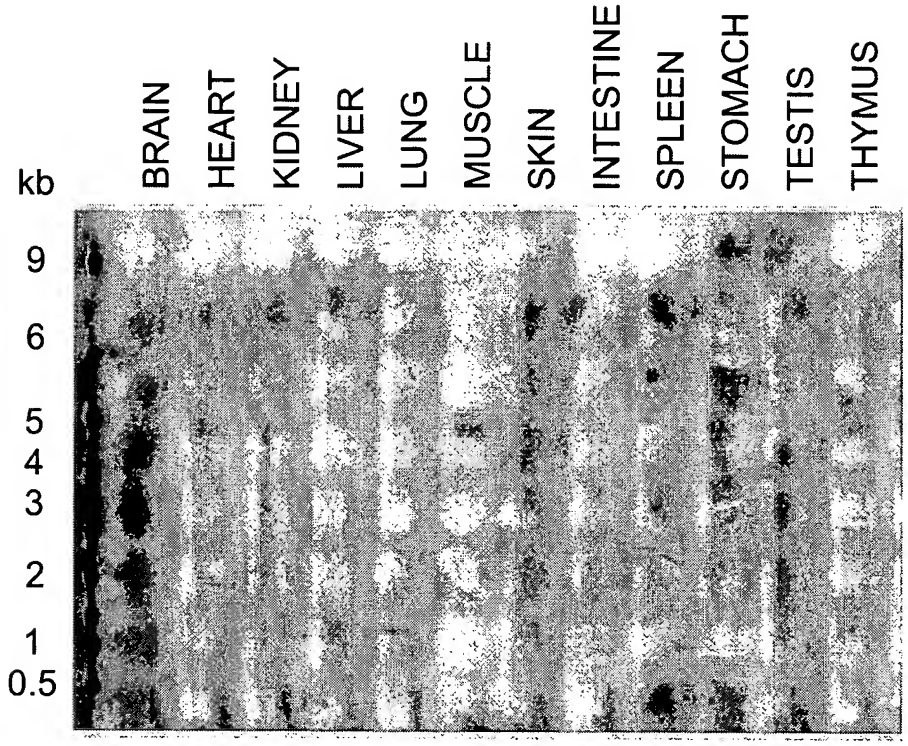


FIG. 4A

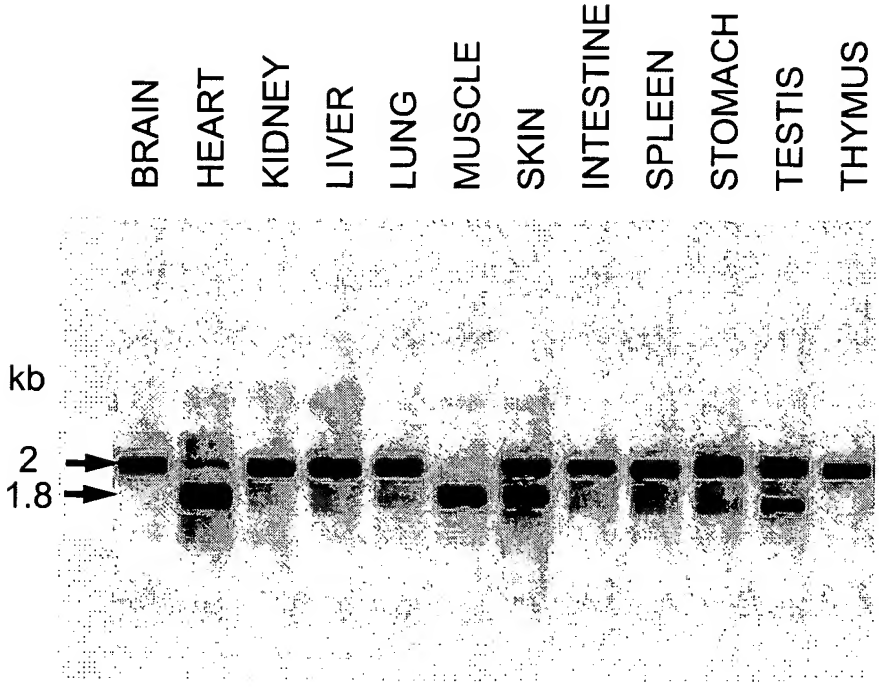


FIG. 5

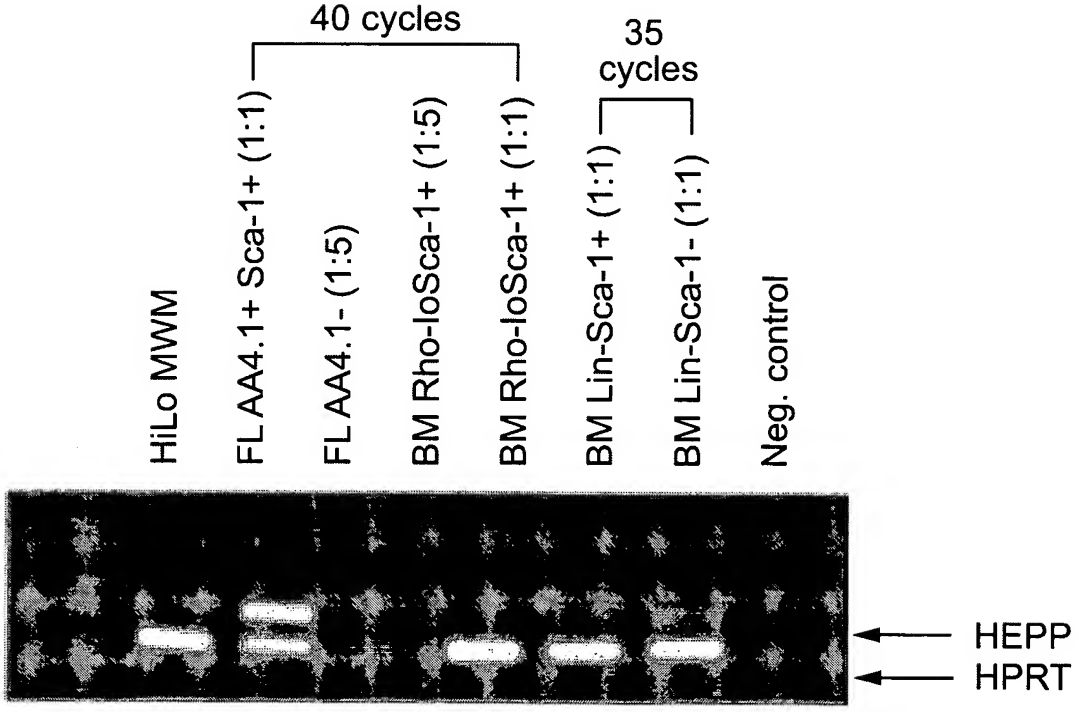
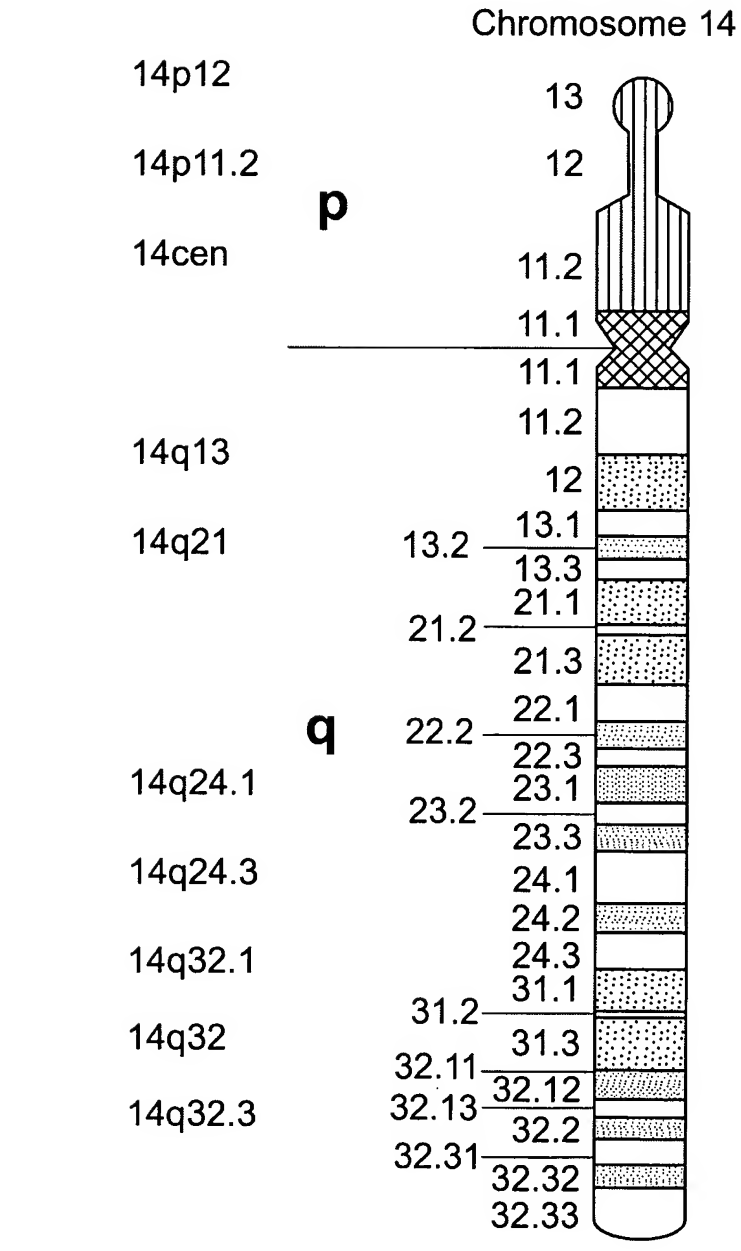


FIG. 6A

FIG. 6B

FIG. 7



translocation breakpoints

FIG. 8

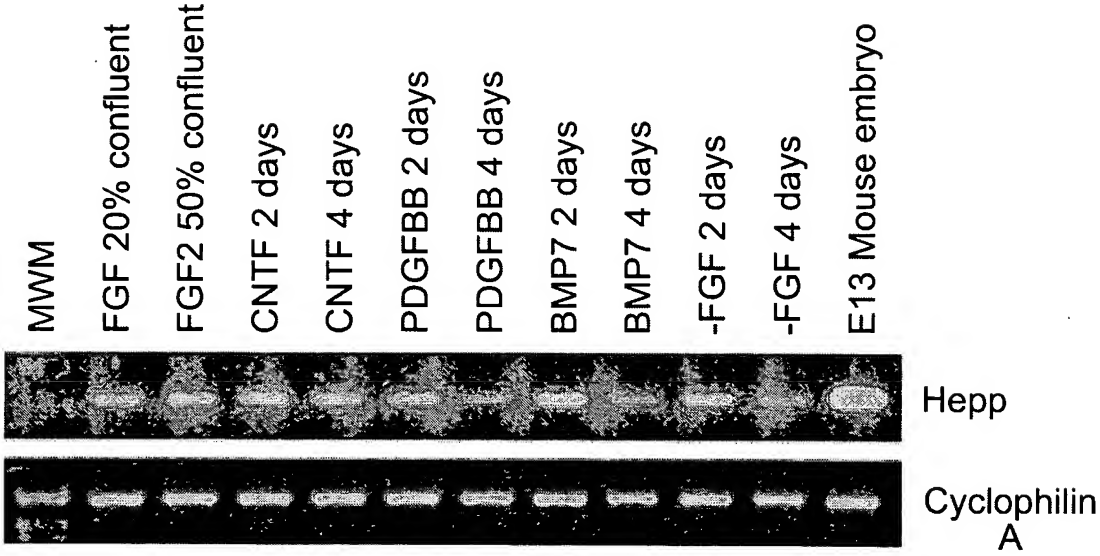
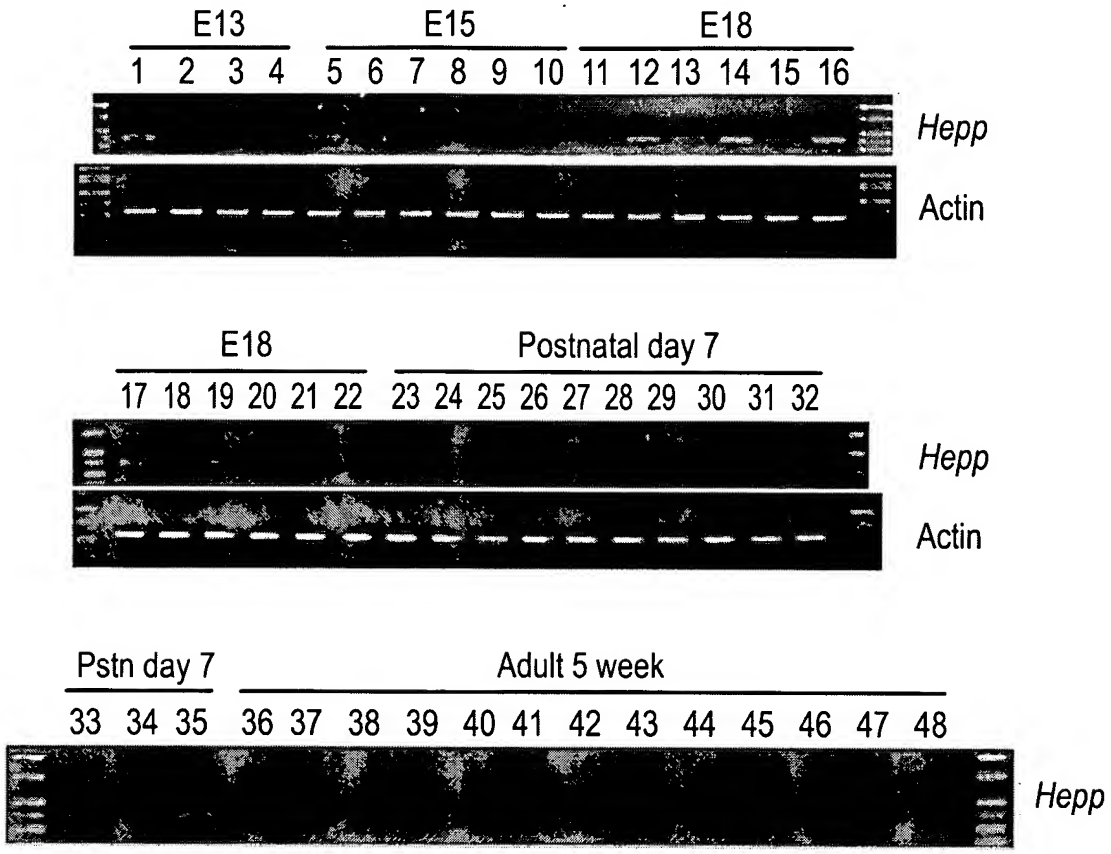


FIG. 9



Embryo day 13
1. Teleocephalon/Diencephalon
2. Mescocephalon (Midbrain)
3. Rhombeocephalon (Hindbrain)
4. Spinal cord

Embryo day 15
5. Teleocephalon
6. Diencephalon
7. Midbrain
8. Pons
9. Medulla
10. Spinal cord

Embryo day 18
11. Frontal cortex
12. Posterior cortex
13. Entorhinal cortex
14. Olfactory bulb
15. Hippocampus
16. Striatum
17. Thalamus
18. Hypothalamus
19. Midbrain
20. Pons
21. Medulla
22. Spinal cord

Postnatal day 7
23. Frontal cortex
24. Posterior cortex
25. Entorchinal cortex
26. Olfactory bulb
27. Hippocampus
28. Striatum
29. Thalamus
30. Hypothalamus
31. Cerebellum
32. Midbrain
33. Pons
34. Medulla
35. Spinal cord

Adult 5 week
36. Frontal cortex
37. Posterior cortex
38. Entorhinal cortex
39. Olfactory bulb
40. Hippocampus
41. Striatum
42. Thalamus
43. Hypothalamus
44. Cerebellum
45. Midbrain
46. Pons
47. Medulla
48. Spinal cord

FIG. 10A

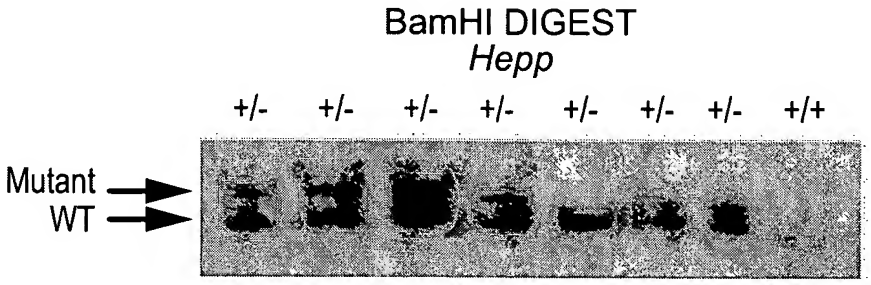


FIG. 10B

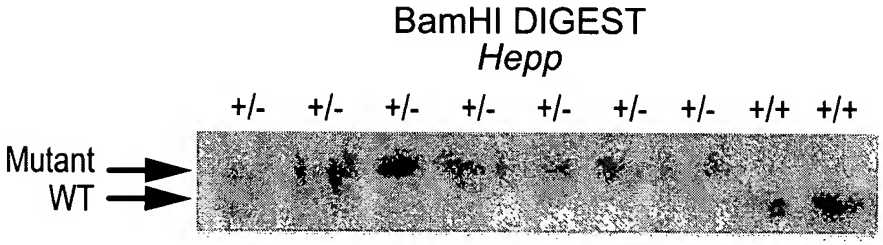


FIG. 11

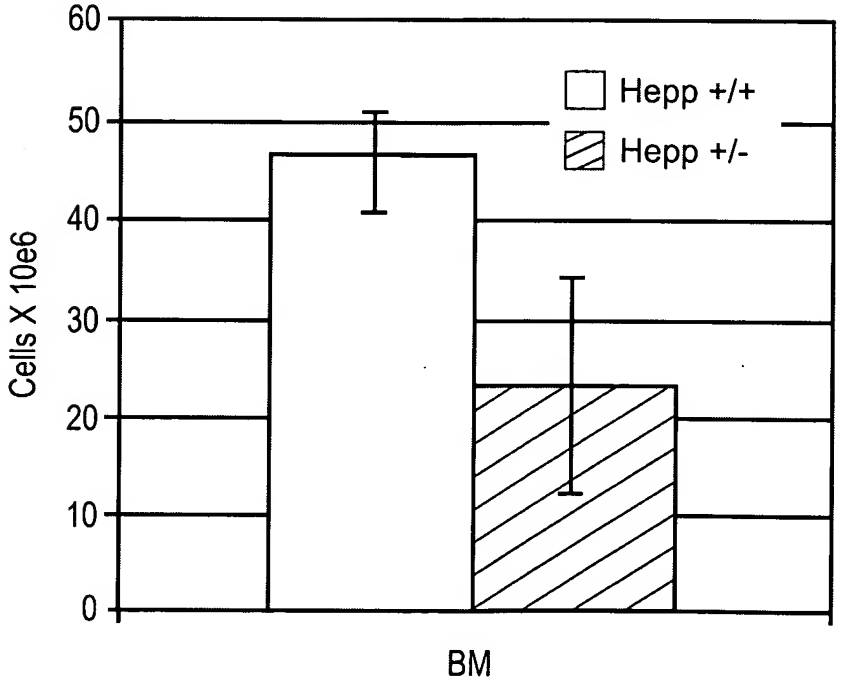


FIG. 12

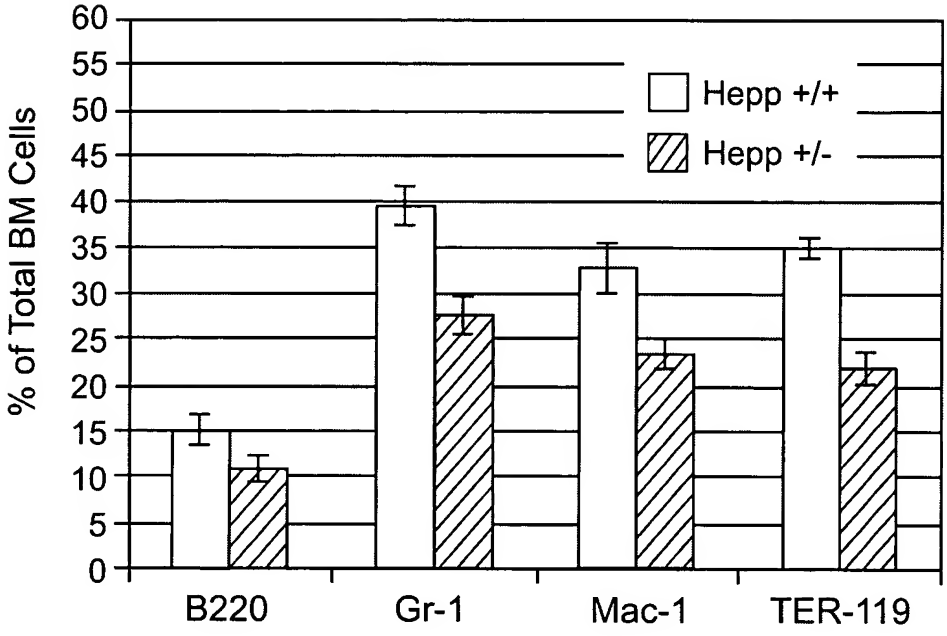

% of Total BM Cells
60
55
50
45
40
35
30
25
20
15
10
5
0
Hepp +/+
Hepp +/-
B220
Gr-1
Mac-1
TER-119

FIG. 13

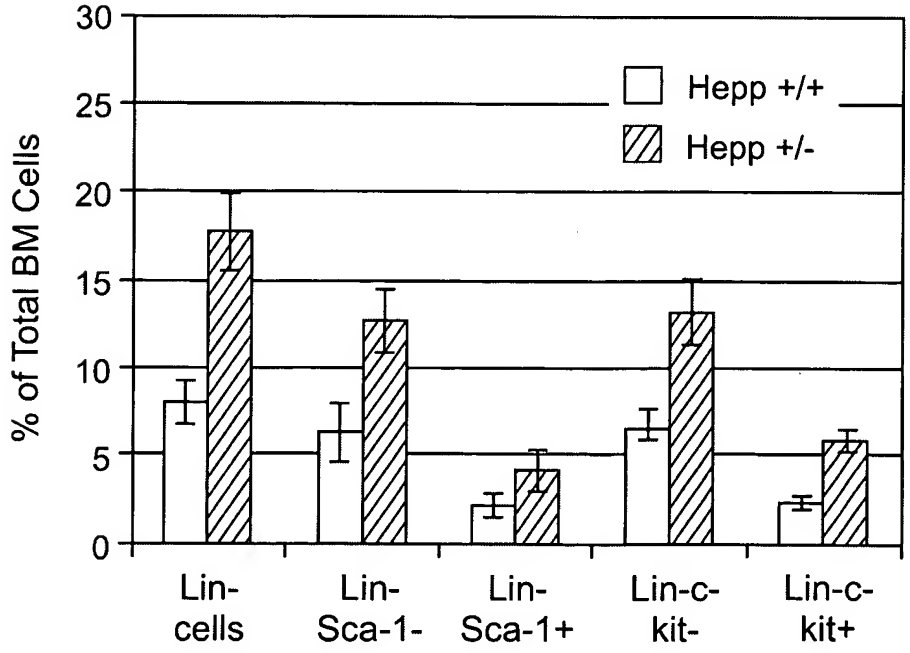

% of Total BM Cells
30
25
20
15
10
5
0
Hepp +/+
Hepp +/-
Lin-cells
Lin-Sca-1-
Lin-Sca-1+
Lin-c-kit-
Lin-c-kit+

FIG. 14

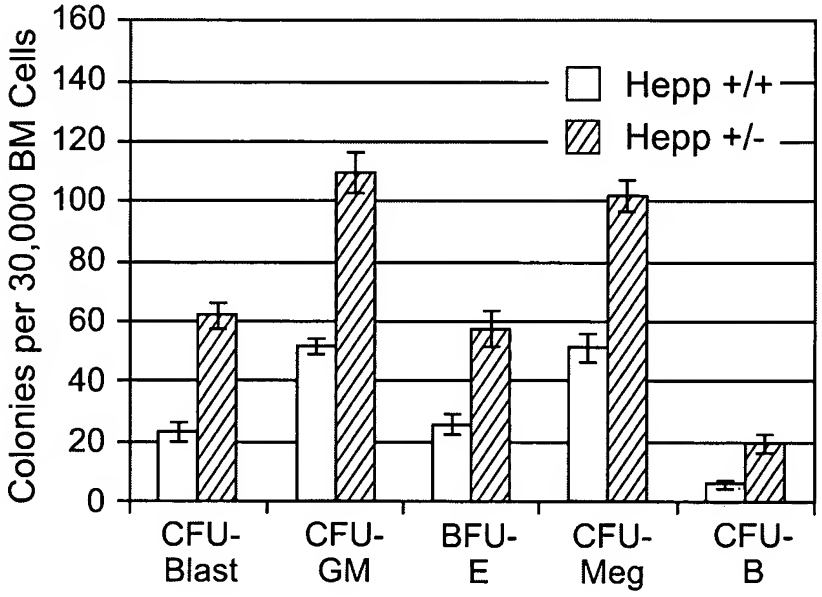


FIG. 15A

Hepp +/+

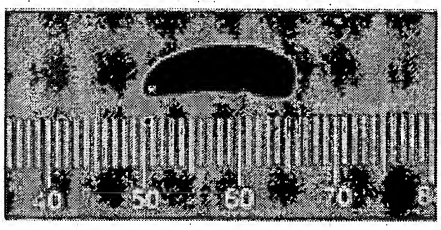


FIG. 15B

Hepp +/-

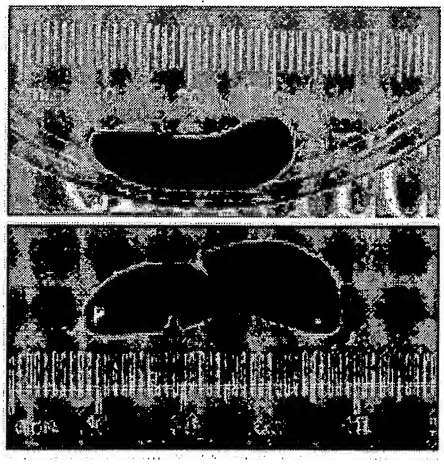


FIG. 15C

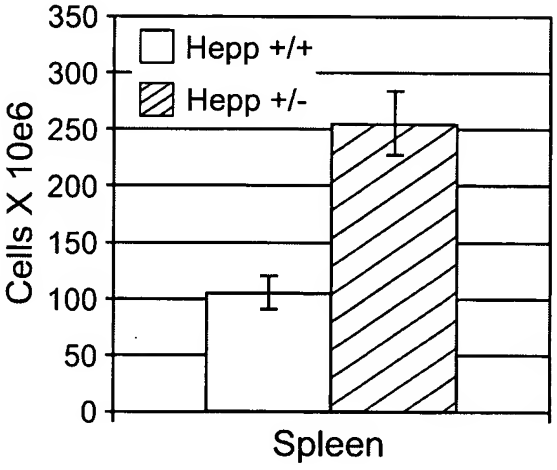


FIG. 16A

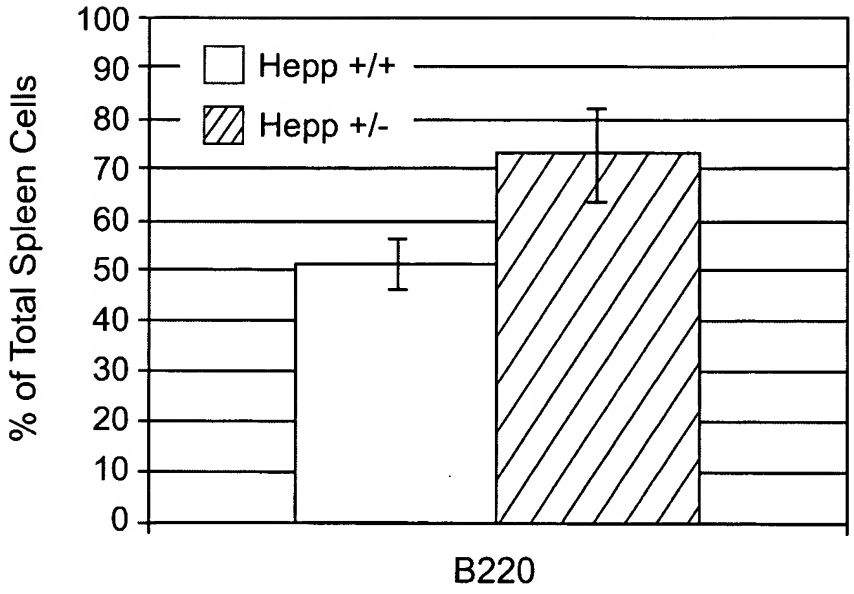


FIG. 16B

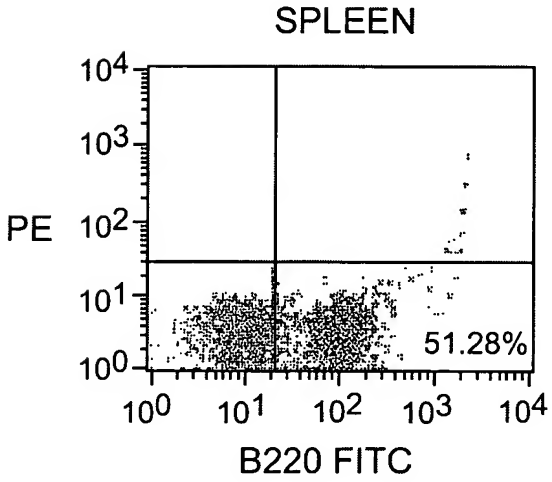


FIG. 16C

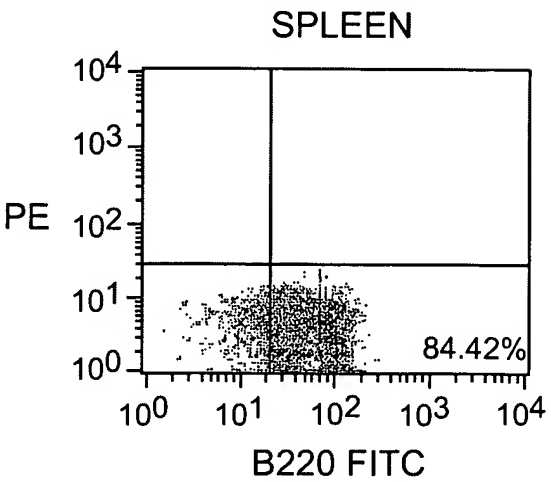


FIG. 17A

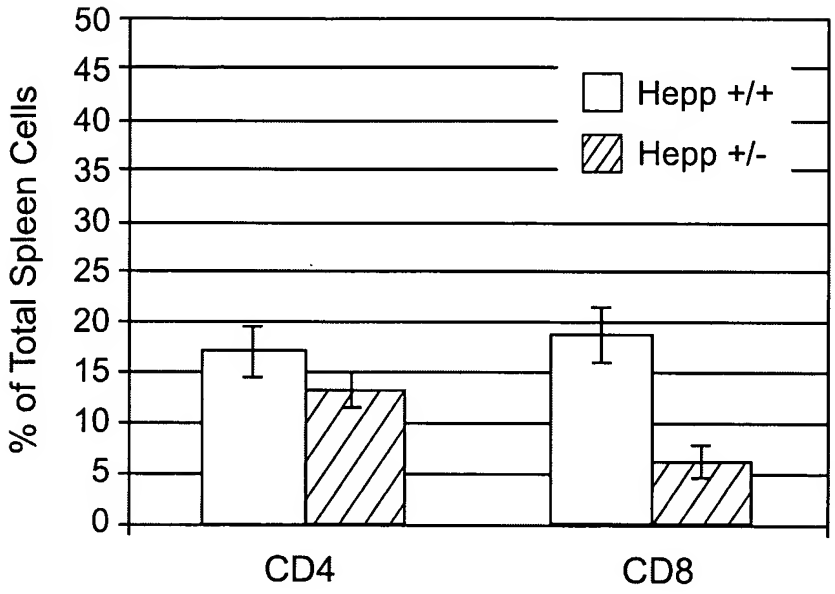


FIG. 17B

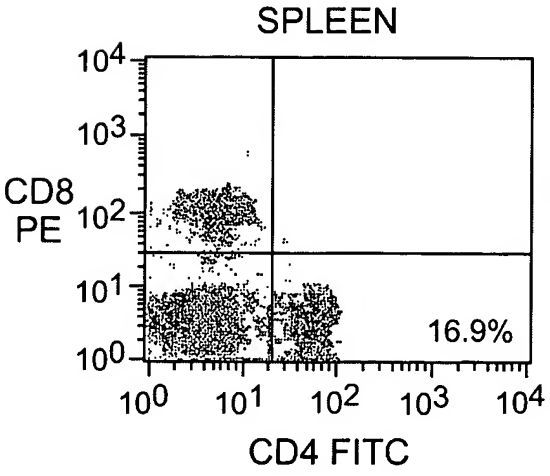


FIG. 17C

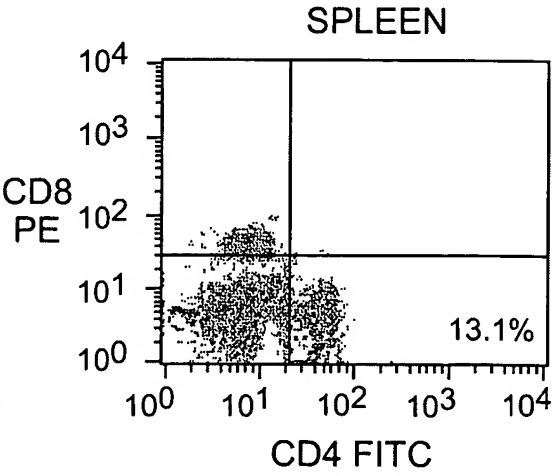


FIG. 18A

FIG. 18B

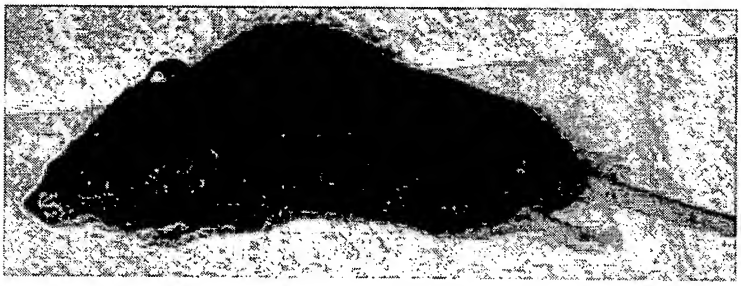


FIG. 18C